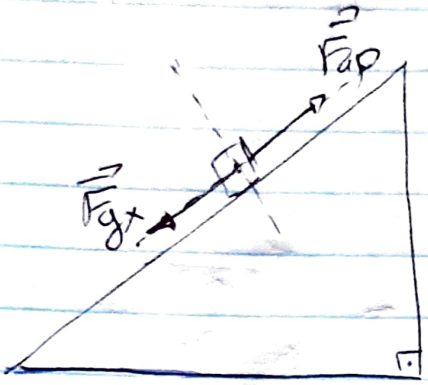
# PROVA 2

**1**




**A** sem atrito:

**A.1** Equilibrar o bloco

$F_{ap} - F_{gx} = 0$

$F_{ap} = F_{gx} = mg \operatorname{sen}\theta$

$F_{ap} = (100)(9{,}80) \cdot \operatorname{sen} 25°$

$= 980 \cdot 0{,}4226$

$$F_{ap} = 414\ N \cong 42{,}3\ kgf$$

**A.2** se abandonado: $a = ?$

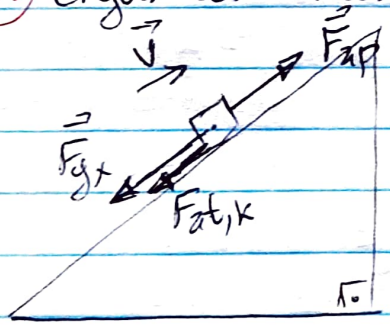
$$a = \frac{F_{res}}{m} = \frac{F_{gx}}{m} = \frac{414\ N}{100}$$

$$a = 4{,}14\ m/s^2$$

**B** com atrito: $\mu_k = 0{,}35$

$\mu_s = 0{,}40$

**B.1** erguer com V constante




$F_{ap} - F_{gx} - F_{at,k} = 0$

$F_{ap} = F_{gx} + F_{at,k}$

$F_{gx} = 414\ N$

$F_{at,k} = \mu_k N = \mu_k mg \cos\theta$

$F_{at,k} = 0{,}35 \cdot 100 \cdot 9{,}80 \cdot \cos 25°$

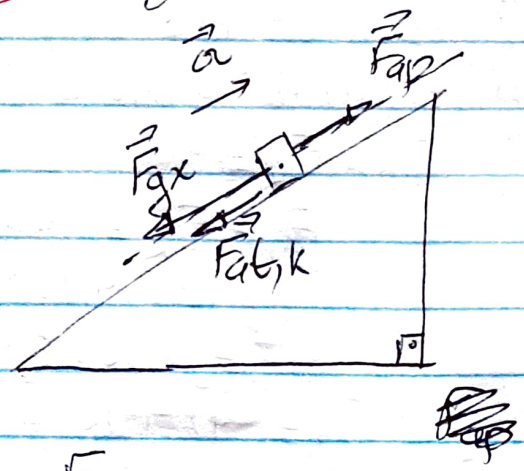
$= 0{,}35 \cdot 980 \cdot 0{,}9063$

$F_{at,k} = 310{,}9$

$F_{ap} = 414 + 311$

$$F_{ap} = 725\ N \cong 74{,}0\ kgf$$

B.2) erguer com aceleração de 0,500 m/s²




$$F_{res} = m \cdot a$$

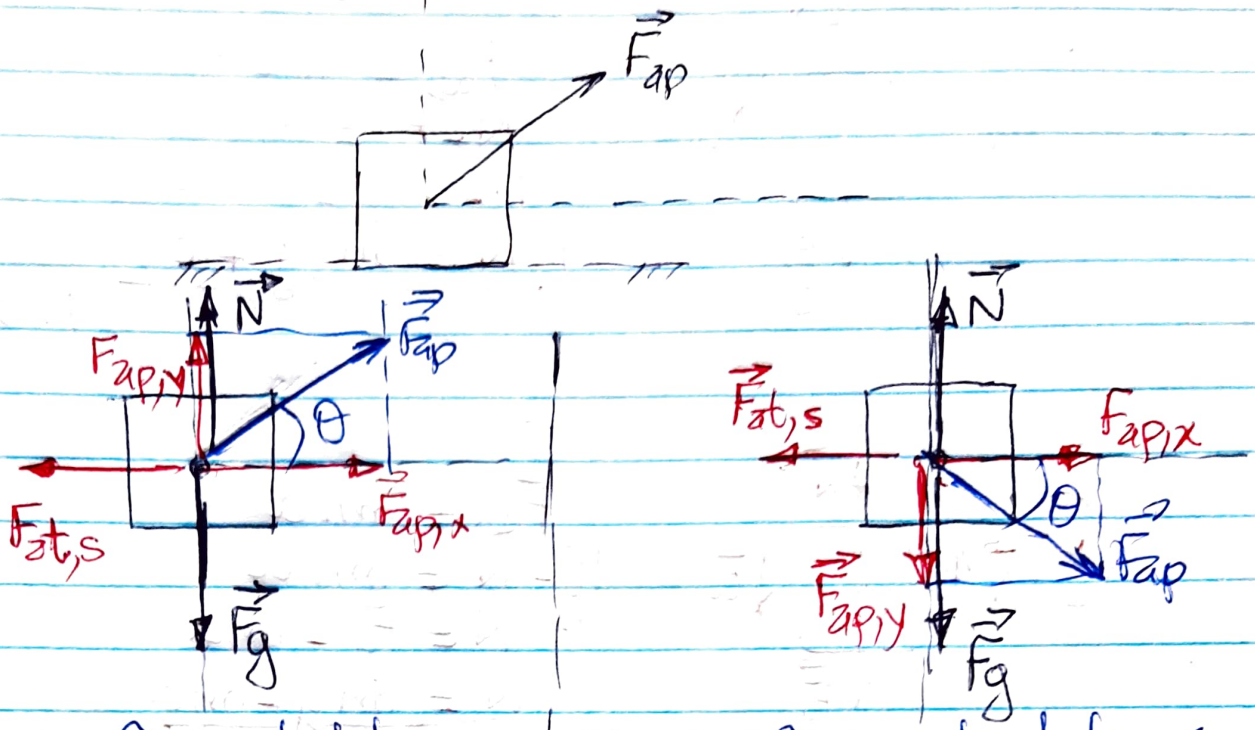
$$F_{ap} - F_{gx} - F_{at,k} = m \cdot a$$

$$F_{ap} = F_{gx} + F_{at,k} + m \cdot a$$

$$= 414 + 311 + 100 \cdot 0,50$$

$$\boxed{F_{ap} = 775\ N \cong 79,1\ kgf}$$

(2)




Na iminência de deslizar:

$F_{ap,x} = F_{at,s}$

$F_{ap}\cos\theta = \mu_s N$

$F_{ap}\cdot\cos 35° = \mu_s N$ ... (1)

Na direção y:

$N + F_{ap,y} - F_g = 0$

$N = F_g - F_{ap,y}$

$N = mg - F_{ap}\cdot\operatorname{sen}\theta$

$N = 100\cdot 9{,}80 - F_{ap}\cdot\operatorname{sen}35°$ ... (2)

(2) em (1):

$F_{ap}\cdot\cos 35° = 0{,}15(980 - F_{ap}\operatorname{sen}35°)$

$0{,}8192\cdot F_{ap} = 147 - 0{,}0860\,F_{ap}$

$F_{ap} = 147$ 0,9052

$F_{ap} = \frac{147}{0{,}9052}$

$F_{ap} = 162{,}4\ N$

Na iminência de deslizar:

$F_{ap,x} = F_{at,s}$

$F_{ap}\cdot\cos\theta = \mu_s N$

$F_{ap}\cdot\cos 35° = \mu_s N$ ... (3)

Na direção y:

$N - F_{ap,y} - F_g = 0$

$N = F_{ap,y} + F_g$

$N = mg + F_{ap}\cdot\operatorname{sen}\theta$

$N = 100\cdot 9{,}80 + F_{ap}\cdot\operatorname{sen}35$ ... (4)

(4) em (3):

$F_{ap}\cdot\cos 35° = 0{,}15(980 + F_{ap}\cdot\operatorname{sen}35°)$

$0{,}8192\,F_{ap} = 147 + 0{,}086\,F_{ap}$

$(0{,}8192 - 0{,}086)\,F_{ap} = 147$

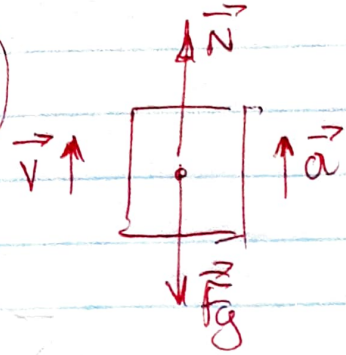
$F_{ap} = \frac{147}{0{,}7332}$

$F_{ap} = 200{,}5\ N$

(3)

$F_{res} = m \cdot a$

**A**




$F_{res} = N - F_g$

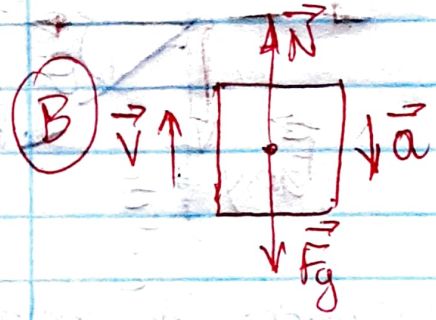
$N - F_g = m \cdot a$

$N - mg = ma$

$\boxed{N = m(g + a)}$

$N >$ peso

**B**




$F_{res} = m \cdot a$

$F_g - N = m \cdot a$

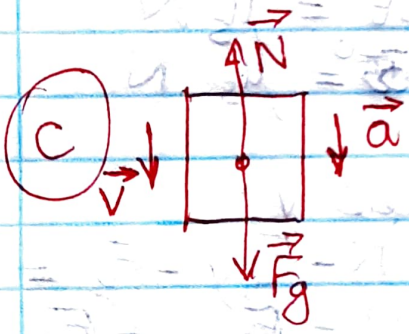
$N = F_g - ma$

$N = mg - ma$

$\boxed{N = m(g - a)}$

$N <$ peso

**C**




$F_{res} = m \cdot a$

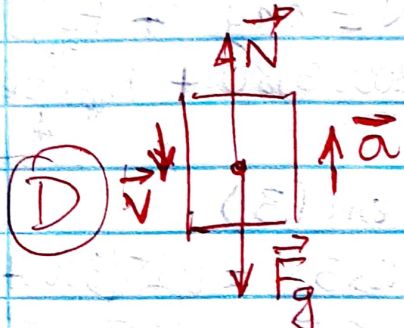
$F_g - N = m \cdot a$

$N = F_g - m \cdot a$

$\boxed{N = m(g - a)}$

$N <$ peso

**D**




$F_{res} = m \cdot a$

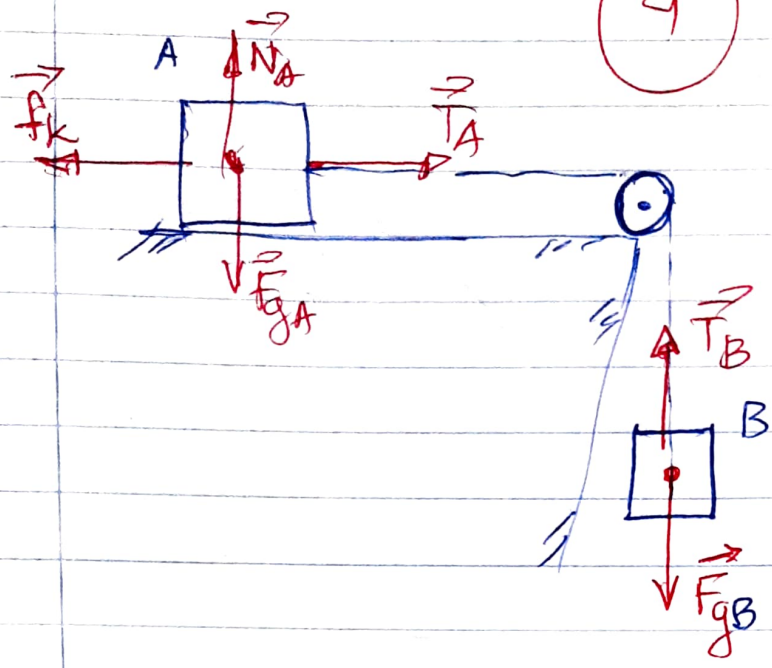
$N - F_g = m \cdot a$

$N = F_g + m \cdot a$

$\boxed{N = m(g + a)}$

$N >$ peso

4




2ª lei em $m_A$:

$F_{res,A} = m_A \cdot a$

$T_A - f_k = m_A \cdot a$

$T_A = T = T_B$

$\therefore T - \mu_k N_A = m_A \cdot a$

$T - \mu_k m_A g = m_A \cdot a$

$T - 0{,}15 \cdot 3{,}00 \cdot 9{,}80 = 3{,}00\,a$

$\boxed{T - 4{,}41 = 3{,}00\,a}$ ...(1)

2ª lei em $m_B$:

$F_{res,B} = m_B \cdot a$

$F_{gB} - T_B = m_B \cdot a$

$m_B \cdot g - T = m_B \cdot a$

$2{,}00 \cdot 9{,}80 - T = 2{,}00\,a$

$\boxed{19{,}6 - T = 2{,}00\,a}$ ...(2)

De (1): $T = 3{,}00\,a + 4{,}41$ ...(3).

(3) em (2):

$19{,}6 - (3{,}00\,a + 4{,}41) = 2{,}00\,a$

$19{,}6 - 3{,}00\,a - 4{,}41 = 2{,}00\,a$

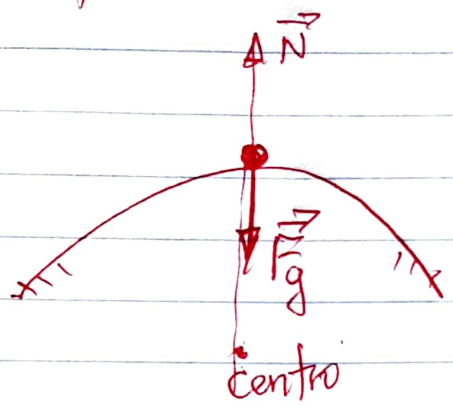
$19{,}6 - 4{,}41 = 2{,}00\,a + 3{,}00\,a$

$15{,}19 = 5{,}00\,a \Rightarrow \boxed{a = 3{,}04\ m/s^2}$

$T = 3{,}00 \cdot 3{,}04 + 4{,}41 \Rightarrow \boxed{T = 13{,}53\ N}$

5

Topo




(A) $F_c = F_g - N$

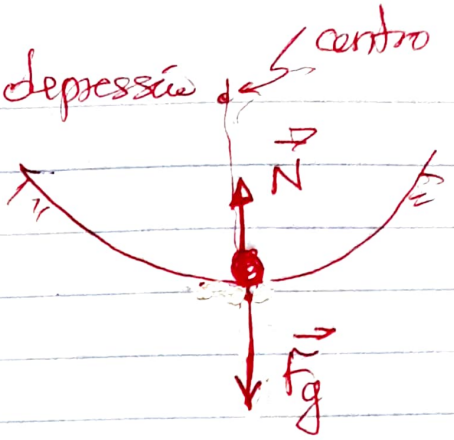
$\therefore N = F_g - F_c$

$N = mg - \frac{mv^2}{R}$

$$\boxed{N = m\left(g - \frac{v^2}{R}\right)}$$

depressão

centro




(A) $F_c = N - F_g$

$N = F_c + F_g$

$N = \frac{mv^2}{R} + mg$

$$\boxed{N = m\left(g + \frac{v^2}{R}\right)}$$

(B) Na iminência de perder contato c/ o solo: $N = 0$

$\therefore 0 = m\left(g - \frac{v^2}{R}\right)$

$\therefore g - \frac{v^2}{R} = 0$

$g = \frac{v^2}{R}$

$V = \sqrt{gR}$

$R = \frac{v^2}{g}$

para $V = 72{,}0\ km/h = 20{,}0\ m/s$

$R = \frac{(20{,}0)^2}{9{,}8}$

$$\boxed{R = 40{,}8\ m}$$

(C) para $N = 2mg$:

$2mg = m\left(g + \frac{v^2}{R}\right)$

$2g = g + \frac{v^2}{R}$

$2g - g = \frac{v^2}{R}$

$g = \frac{v^2}{R} \Rightarrow V = \sqrt{gR}$

$R = \frac{v^2}{g}$

para $V = 72{,}00\ km/h = 20{,}0\ m/s$

$R = \frac{(20{,}0)^2}{g}$

$$\boxed{R = 40{,}8\ m}$$